DOCUMENT RESUME

ED 113 579 CE 005 330

AUTHOR	Harris, Randolph K.; Huckell, Raymond K., Jr.
TITLE	Predicting Academic Success in Secondary Schools From the General Technical Composite on the Armed Services Vocational Aptitude Battery.
INSTITUTION	Armed Forces Vocational Testing Group, Randolph AFB, Tex. Research Div.
REPORT NO	AFVTG-TR-74-2; VT-102-128
PUB DATE	Dec 74
NOTE	18p.; For related document, see CE 005 331
EDRS PRICE	MF-$0.76 HC-$1.58 Plus Postage
DESCRIPTORS	Academic Achievement; *Aptitude Tests; Armed Forces; Correlation; Grade 11; Grade 12; *Grade Point Average; *High School Students; *Predictive Ability (Testing); Tables (Data); Test Results; *Vocational Aptitude
IDENTIFIERS	*Armed Services Vocational Aptitude Battery; ASVAB; Texas (San Antonio)

ABSTRACT

The study reports correlations between student scores on the general technical composite of the Armed Services Vocational Aptitude Battery and cumulative grade point averages. Data were collected on 911 juniors and seniors selected from a sample at 22 high schools in the San Antonio, Texas, metropolitan area. The general technical score was found to significantly relate to overall academic performance for 19 out of the 22 samples, with a media rank order correlation coefficient (rho) of .44. Results indicate that the level of relationship was not differentially affected by school-specific ethnic group composition, school expenditures, or average teacher/pupil ratio. Since socioeconomic levels represented in the various samples go from the highest to the lowest ranges, limited generalizations may be meaningful to other school districts with similar diverse populations. The report is designed for reference by high school counselors, service test administrators, and educational specialists as a supplemental guide to the interpretation of Armed Services Vocational Aptitude Battery results in local guidance and counseling programs. (Author/MF)

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ED113579

AFVTG TECHNICAL RESEARCH REPORT NUMBER 74-2

PREDICTING ACADEMIC SUCCESS IN SECONDARY SCHOOLS FROM THE GENERAL TECHNICAL COMPOSITE ON THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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DECEMBER 1974

(VT 102 128)

CE005 330

RESEARCH DIVISION
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Armed Forces Vocational Testing Group Technical Research Reports and Technical Research Notes are developed for primary use and reference by secondary school counselors and Department of Defense Armed Services Vocational Aptitude Battery (ASVAB) test administrators and educational specialists. This report is presented in a format to facilitate field application by secondary school counselors, test administrators, and educational specialists. Conclusions and recommendations are solely those of the primary authors and in no way represent official policy of either the military services or the Department of Defense.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 74-2	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Predicting Academic in Secondary Schools from the General Technical Composite on the Armed Services Vocational Aptitude Battery		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER 74-2
7. AUTHOR(s) Randolph K. Harris Raymond K. Huckell Jr.		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Armed Forces Vocational Testing Group Randolph AFB, TX 78148		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AFVTG 117
11. CONTROLLING OFFICE NAME AND ADDRESS Armed Forces Vocational Testing Group Randolph AFB, TX 78148 AFVTG/RD		12. REPORT DATE December 1974 13. NUMBER OF PAGES 9
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Predicting Academic Success, Secondary Schools, San Antonio, Composite, Armed Services Vocational Aptitude Battery, ASVAB, Validity Coefficients, Correlation Coefficients, General Technical, GT, Grade Point Average, G.P.A., Sampling Technique, Texas Education Agency.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This Technical Research Note reports correlations between student scores on the General Technical (GT) composite of the Armed Services Vocational Aptitude Battery and cumulative grade point averages (GPAs). Data were collected on 911 juniors and seniors selected from a sample at 22 secondary schools in the San Antonio metropolitan area.

The GT score was found to significantly relate to overall academic performance

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for 19 out of the 22 samples, with a median rho of 44. Results indicate that the level of relationship was not differentially affected by school- specific ethnic group composition, school expenditures, or average teacher/pupil ratio.

Neither the samples used nor conclusions presented in this study should be construed as representative of high schools throughout the country. Since socio-economic levels represented in the various samples go from the highest to the lowest ranges, limited generalizations may be meaningful to other school districts with similar diverse populations.

This is an initial report exploring the relationship between student performance on various ASVAB scales and various criteria in the civilian academic sector. Additional studies will further assess relationships across various grade levels, in differing types of training situations, and across different time spans. As such, this first study should be interpreted as a prelude to additional and more comprehensive analyses of the Armed Services Vocational Aptitude Battery.

Technical Research Report 74-2

PREDICTING ACADEMIC SUCCESS IN SECONDARY SCHOOLS FROM THE GENERAL TECHNICAL COMPOSITE ON THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY

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PREFACE

This Technical Report is designed for reference by high school counselors, service test administrators, and educational specialists as a supplemental guide to the interpretation of Armed Services Vocational Aptitude Battery (ASVAB) results in local guidance and counseling programs.

Data summarized in this Technical Research Note were collected on 911 students randomly selected from a sample of 22 secondary schools in the San Antonio metropolitan area. School samples were obtained through voluntary participation. The investigators are indebted to all participating counselors, administrative personnel, and principals. Special appreciation is owed to Miss Barbara Beverly, Research Division, Texas Education Agency, Austin, Texas, and Mr. Roy Balter, Coordinator of Guidance, Northeast Independent School District, San Antonio, Texas.

ABSTRACT

This Technical Research Note reports correlations between student scores on the General Technical (GT) composite of the Armed Services Vocational Aptitude Battery and cumulative grade point averages (GPAs). Data were collected on 911 juniors and seniors selected from a sample at 22 secondary schools in the San Antonio metropolitan area.

The GT score was found to significantly relate to overall academic performance for 19 out of the 22 samples, with a median rho of .44. Results indicate that the level of relationship was not differentially affected by school-specific ethnic group composition, school expenditures, or average teacher/pupil ratio.

Neither the samples used nor conclusions presented in this study should be construed as representative of high schools throughout the country. Since socio-economic levels represented in the various samples go from the highest to the lowest ranges, limited generalizations may be meaningful to other school districts with similar diverse populations.

This is an initial report exploring the relationship between student performance on various ASVAB scales and various criteria in the civilian academic sector. Additional studies will further assess relationships across various grade levels, in differing types of training situations, and across different time spans. As such, this first study should be interpreted as a prelude to additional and more comprehensive analyses of the Armed Services Vocational Aptitude Battery.

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PREDICTING ACADEMIC SUCCESS IN SECONDARY SCHOOLS FROM THE GENERAL TECHNICAL COMPOSITE ON THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY

I. INTRODUCTION AND BACKGROUND

Since introduction of the Armed Services Vocational Aptitude Battery (ASVAB) into the national high school counseling environment in 1968, two validation and interpretative studies have been conducted on the instrument within the military services (Vitola, Mullins, and Croll, 1973; Thomas, 1970).

The traditional criterion used within such studies has been evaluation against success in training in military technical schools. Comparable data (for an aptitude battery designed primarily for service enlisted screening and job classification purposes) has not been accumulated on civilian student samples.

The basic objective of this research study was to explore the relationship between a single dimension of ASVAB performance and overall grade point averages (GPAs) for a regional sampling of high school students. The ASVAB component chosen as the predictor variable was student scores on the General Technical Composites, consisting of unit weighting the two subtests of Word Knowledge and Arithmetic Reasoning. A full description of all ASVAB subtests used in reporting results to high school counselors and students appears in Appendix 1. The student GPA was chosen as the criterion because it was readily available and approximates overall academic standing of students within the microcosm of a specific school system. For the purposes of this study, directed primarily toward senior samples, a cumulative four-year GPA, covering an average of six courses, per year, was chosen as the optimum available criterion variable.

Several researchers have demonstrated that global measures of intelligence consistently correlate with various measures of scholastic achievement. Traxler (1937) reported that global measures of intelligence correlated significantly with measures of scholastic achievement, whether the criterion be teacher's marks or student scores on standardized achievement and aptitude tests. In an earlier study, Gates (1922) summarized that, in general, verbal tests seemed to be the better predictors of achievement than other aptitude scales. The range of validity coefficients for the elementary level was from +.65 to +.79; at the secondary level, the range was +.50 to +.60. In a similar vein, Byrns, Ruth, and Henmon (1935) found significant relationships between verbal aptitude measures and overall academic standing (i.e., GPA) as early as the fourth grade.

In summarizing the results of 12 studies correlating global measures of intelligence with attained GPA for courses attempted, Ross and Hooks (1930) found relationships from +.12 to +.69 with a median correlation coefficient of +.48. In a similar review reported in Miller (1961), Travers estimated the probable range of coefficients obtained between various intelligence tests and grades in academic subjects to be between +.40 and +.60.

In operational industrial training environments, similar findings have been summarized which demonstrate consistent and significant relationships between scores on tests of intellectual abilities and performance in training. To the extent that the learning environments are parallel between secondary high school systems and industrial/service training programs, the results of such research in the industrial setting are of interest to the basic concern of the present study (viz. demonstrating the relationship(s) between an overall measure

of general aptitude and success in academic situations). In his landmark report, Ghiselli (1973) summarized literature published between 1920 and 1971 reporting relationship between various test classifications and measures of job performance and various training criteria. As a generalized finding, Ghiselli reported that tests of general intellectual abilities were consistently better predictors of success in training than more specific and non-cognitive measures across the eight job classifications examined. Similarly, within the service training environment, both Vitola, et. al. (op. cit.) and Thomas (op. cit.) have shown that, if one were limited to a single composite to predict the performance of enlisted personnel across all the technical training schools examined, the General Technical composite of the ASVAB is more effective than any other composite predictor in use within the military service training environment.

II. PROCEDURE

A random sample of 22 high schools in the San Antonio, Texas metropolitan area were contacted and voluntarily agreed to participate. The San Antonio area was selected as the sampling area because of: (1) easy access to the investigating agency, and (2) organization of the San Antonio area schools into 16 autonomous and independent school districts which include five different ethnic groupings across various socio-economic levels.

A. **Sample Selection:** It was decided to limit the sample to juniors/seniors possessing ASVAB scores obtained during school year (SY) 1973-74. The 22 high schools were randomly selected from a total of 38 available in the San Antonio regional area. The criteria for inclusion in the population group from which the samples were drawn were that the school be fully accredited by the Texas Education Agency, offer a full program, and be ASVAB tested during SY 1973-74. To precoordinate the study with school officials, initial contact was established by phone and supplemented by a follow-on letter describing objectives of the study and data required from participating schools (Appendix 2). Of the 22 schools initially contacted, all agreed to full participation. Total anonymity was provided to all schools and students in the sample.

For each school, a listing was prepared on all students tested during SY 1973-74 by name, grade, class rank, yearly grade point average, sex, ethnic group, and social security account number. Using the Table of Random Digits (Interstate Commerce Commission, undated) samples were randomly chosen from ASVAB student lists compiled for each school.

B. **Compilation of Criterion Data:** Cumulative grade point averages (GPAs) were provided for students identified in the sample by either a counselor assigned to a school or by the responsible district vocational guidance coordinator. The cumulative GPAs (i.e., three years for juniors and four years for seniors) transformed into overall student rank orders within samples, were selected as the best overall indicator of academic standing.

C. **Population Characteristics:** One of the primary considerations underlying selection of the San Antonio regional school populations for this preliminary study was the broad diversity across schools in the area by ethnic, socio-economic, and curricular strata. Ranges for relevant socio-economic population variables across the 16 school districts from which the school sample was selected are summarized in Table 1. Data were collected from District Superintendents and the Research Division, Texas Education Agency, Austin, Texas. The data in Table 1 are provided as an aid toward permitting generalizing, as warranted, of research findings to school systems having similar socio-economic population characteristics.

Table 1

RANGES OF SCHOOL ASSOCIATED SOCIO-ECONOMIC VARIABLES
(SAN ANTONIO METROPOLITAN AREA)

Variable	High Value	Mean	Low Value
Teacher/Pupil Ratio (all grades)	1/24	1/20	1/18
Average Cost Per Pupil	$913.15	$670.00	$569.69
Percent Enrollment by Ethnic Group			
Black	15.6	7.4	0.0
Oriental	2.0	.7	0.0
Spanish/American Surname	89.6	51.0	0.0
Other	90.6	41.2	2.8
Beginning Teacher Salaries (Bachelor's Degree)	$8100	$7675	$7200

All independent school districts in San Antonio except three had cultural enrichment programs, and all except two had special curricula for the physically or mentally handicapped.

III. RESULTS

A. Sample Description: Table 2 shows individual schools (identified by letter grade) participating in the study, the date of ASVAB testing, total number of students tested, number of seniors tested, number of students in the sample, and number of females in the sample.

Due to the diverse methods used by schools to compute student grades, various scales associated with the GPA and small sample sizes, the data most closely fit the assumptions underlying analysis by non-parametric statistical methods. Consequently, the rank order correlation coefficient (rho) was applied as the measure of estimated relationship between the predictor (GT score) and the criterion (three- or four-year cumulative GPA). Rho values, mean GPA, and GT values are shown in Table 3 for each sample. Means reported for the GT score represent transformation of raw score values to a standard scale having a mean of 100 and a standard deviation of 15.

The range of rho for sample sizes greater than 30 was from .32 to .77 with an overall median value of .54. It is interesting to note that all non-significant rhos were found associated with small size samples. Mean correlation value for school samples tested only with juniors (i.e., samples O, Q, and V), using Fisher's transformation (Guilford, 1965), was .54 contrasted to an average rho across the remaining samples of .51. With degrees of freedom, 179 and 726, the resultant estimated z value = .37, indicating the samples could have come from the same

Table 2

STUDENT SAMPLES (TESTED ON ASVAB, SY73-74)

School	Date Tested	Students Tested	Seniors Tested	Number in Sample	Number of Females in Sample
A	2/74 a	315	68	50	0
B	12/73 a	253	243	48	14
C	10/73	124	124	47	13
D	2/74	260	75	39	23
E	10/73	342	333	71	42
F	12/73	10	6	5	0
G	11/73	250	100	49	26
H	10/73	226	81	50	25
I	12/73 a	47	38	35	17
J	10/73 a	90	88	49	26
K	11/73	260	55	47	23
L	11/73	418	195	50	21
M	9/73	89	88	46	15
N	2/74	37	37	37	5
O	10/73 b	11	1	10	10
P	10/73	71	13	13	2
Q	11/73 b	494	2	42	25
R	11/73	85	85	47	23
S	10/73	614	247	51	26
T	10/73	99	53	51	0
U	11/73 a	68	66	42	17
V	10/73 b	71	13	32	2
TOTALS		4095	1932	911	355

a Tested on Form 2; all other tested on ASVAB, Form 1.

b All juniors in sample; all others are senior samples.

population with respect to the relationship between GT scores and overall GPA values.

Similarly, schools tested on Form 2 (samples A, B, I, J, and U) showed a transformed average rho = .44, compared to an average rho = .52 across schools where Form 1 was administered. The test of significance shows z = less than unity, again non-significant at $p < .05$. A more complete analysis, with related tests of significance regarding these type differences (between grades, test form, and sex), will be reported in a later research note.

IV. DISCUSSION

As reflected in Table 1, the San Antonio area has differences between school districts in terms of ethnic group distributions, underlying levels of expenditure, expenditures per pupil, and

Table 3

GPA AND GT MEANS—INTERCORRELATIONS

School	N	Mean *a GPA	Mean GT Score	rho
A	50	2.86	117.00	.65**
B	48	2.20	88.75	.55**
C	47	77.29	104.85	.66**
D	39	2.34	93.79	.45**
E	71	79.89	100.52	.77**
F	5	76.89	117.20	.02
G	49	2.98	84.31	.52**
H	50	79.31	94.58	.34*
I	35	3.33	85.11	.32*
J	49	85.98	112.88	.61**
K	47	76.17	103.08	.46**
L	50	4.48	101.78	.65**
M	46	2.20	102.63	.51**
N	37	2.20	96.57	.64**
O	10	2.77	107.90	.20
P	13	3.97	98.84	.16
Q	42	77.48	88.36	.67**
R	47	76.46	78.43	.53**
S	51	2.12	78.43	.53**
T	51	78.64	92.90	.63**
U	42	78.83	101.43	.55**
V	32	76.18	99.09	.44**

*a (1) Samples B, C, N, O, S: 4.00 grading system
(2) Samples G and I: 9.00 grading system
(3) Sample L: 6.00 grading system
(4) Remaining samples: Numeric averages ranging from 0 to 100

* - Sig. .05 level

** - Sig. .01 level

related socio-economic variables. These differences are, in turn, represented across the various school samples studied in this report. The results reported in Table 3 indicate that the level of relationship between a general aptitude measure and overall GPA is not differentially affected by school ethnic group composition, school expenditures, or average teacher/pupil ratio. This conclusion is supported by data reported in Table 3, in spite of marked difference between samples in aptitude test performance. Stated another way, the results of this study imply that students from the poorer economic districts, as estimated from per capita expenditures, do not perform appreciably different—in terms of the predictability of academic ranking from ASVAB GT scores—than

do students from the more affluent districts, as estimated from per capita expenditures.

Principally because of the high concentration of students with Spanish surnames and the lesser concentration of students from other ethnic groups among the students in school districts in this study, neither the samples used nor conclusions presented should be construed as representative of high schools throughout the country. However, limited generalizations from trends shown in this study may be meaningful to other school districts with diverse populations, since socio-economic levels represented here go from the highest to the lowest ranges.

The range of correlations attained in this study (Table 3) compare favorably with results reported by other investigators, notably Gates (1922) and Ross and Hooks (1930).

V. CONCLUSIONS—IMPLICATIONS FOR FURTHER RESEARCH

The General Technical Composite (GT score) derived from the ASVAB was found to be significantly related to overall academic performance for student samples in 19 out of the 22 school samples in the San Antonio metropolitan area. This finding is comparable to similar studies exploring relationships between measures of general intelligence and academic performance (Bolton, 1952; Frederiksen and Schrader, 1952; Gates, 1922; Ross and Hooks, 1930; and Traxler, 1937). Users of ASVAB are cautioned that uniqueness of the organization of the San Antonio School System, coupled with the high density of students with Spanish surnames, render the results cautiously applicable at the national level.

Several avenues for further research are indicated as an outgrowth of this study. First, using the data base already accumulated on San Antonio school samples, exploration of the differential predictive effectiveness of each ASVAB subtest as related to overall GPA, with separate correlational analyses computed for male and female samples, is planned.

Replication of this study would appear profitable, using grade levels other than seniors (with expansion of junior samples) and administered in other school systems. Test results on individual ASVAB scales across grades should also be examined as to their value/utility in predicting first-year college success.

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Appendix 1

DESCRIPTION OF ASVAB SUBTESTS

TESTS IN THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY (ASVAB)

1. **Coding Speed Test (CS).** In this test there is a key and 100 items. The key is a group of words with a code number for each word. Each item presents one word for which the examinee indicates the code number.

2. **Word Knowledge (WK).** Each item requires the examinee to select the correct synonym for a specified word.

3. **Arithmetic Reasoning (AR).** Each item is a reasoning problem involving application of the arithmetic process.

4. **Tool Knowledge (TK).** Each item presents five drawings of various tools or shop equipment. The examinee indicates which of the four alternative drawings goes best with the lead drawing.

5. **Space Perception (SP).** Each item consists of five drawings: A pattern and four boxes. The question to be answered is which one of the boxes can be made by folding the pattern.

6. **Automotive Information (AI).** Each item asks a question about the identification or operation of automobile parts.

7. **Shop Information (SI).** This test has questions about shop practices and the use of tools. Many of the items contain drawings.

8. **Mechanical Comprehension (MC).** Each item includes a drawing, or drawings, illustrating some physical principle and a question.

9. **Electronic Information (EI).** This test has questions about elementary principles of electricity and about electrical/electronic devices, drawings, and equipment.

Appendix 2

SAMPLE LETTER TO SCHOOL ADMINISTRATOR

(Date)

Addressee Instructions

Dear Mr./Mrs. Smith

This is a followup to your telephone conversation on _____ with _____, Chief of our Research Branch. We are grateful to you for your prompt cooperation.

As _____ explained, The Armed Forces Vocational Testing Group is a joint service, Department of Defense activity, located at Randolph Air Force Base. This organization manages the Armed Services Vocational Aptitude Battery (ASVAB), which has been administered to over one million students this year.

Our Research Division is expanding the validation base of ASVAB through a research project in the San Antonio area. We have selected 22 high schools, including _____, for use in our sample. Additionally, we have randomly selected students from the seniors who took the ASVAB during school year 1973/74 at _____. If you would please mail (or we will pick up) your end-of-school year (or third quarter) academic rankings or grade point averages for the senior students on the attached listing, it will assist us in completing this study.

The information provided will be kept in strict confidence and will be correlated with ASVAB results to determine whether we can accurately answer the following questions: (1) can the ASVAB be used to predict academic success, and (2) if so, to what extent? You will be furnished a copy of the final report, by the opening of the fall (1974) school year. In order to preclude misunderstandings in your community, we request that students and their parents be informed of the study, what data you are furnishing us, and the procedure we plan to use to maintain anonymity.

If the data collection will impose any administrative burden on your staff, we will provide staff personnel to assist you or to accomplish the records research. Should you desire additional information on the project, please feel free to call either myself (652-2481) or _____ _____ (652-2483).

Sincerely

MICHAEL M. DAVIS, Colonel, USA
Director, Research Division

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Listing

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ATC 221